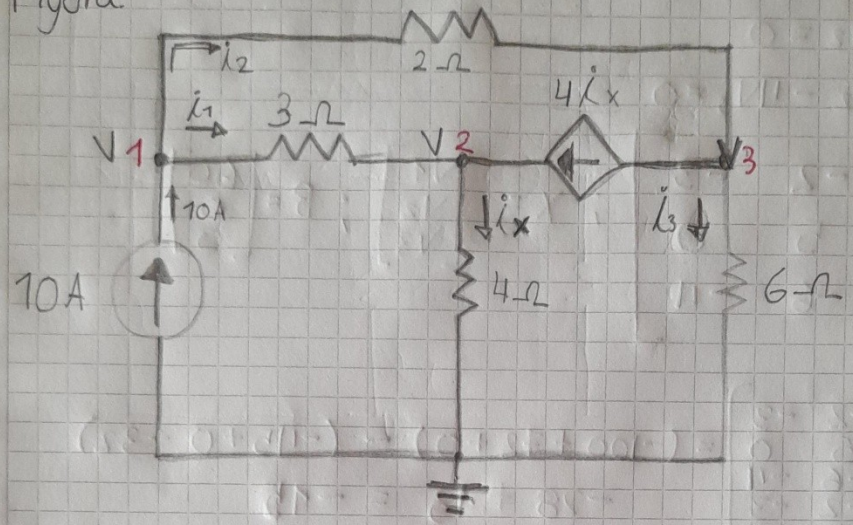
Halle las tensiones de los 3 nodos de no referencia y las corrientes en el circuito de la figura



• Nodo 1

$10 = i_1 + i_2$

$10 = \frac{V_1 - V_2}{3} + \frac{V_1 - V_3}{2}$

$60 = 2V_1 - 2V_2 + 3V_1 - 3V_3$

$60 = 5V_1 - 2V_2 - 3V_3$

• Nodo 2

$i_1 + 4i_x = i_x$

$\frac{V_1 - V_2}{3} + 4\left(\frac{V_2}{4}\right) = \frac{V_2}{4}$

$\frac{V_1 - V_2}{3} + V_2 = \frac{V_2}{4}$

$4V_1 - 4V_2 + 12V_2 = 3V_2$

$4V_1 + 5V_2 = 0$

• Nodo 3

$i_2 = 4i_x + i_3$

$\frac{V_1 - V_3}{2} = 4\left(\frac{V_2}{4}\right) + \frac{V_3}{6}$

$\frac{V_1 - V_3}{2} = V_2 + \frac{V_3}{6}$

$3V_1 - 3V_3 = 6V_2 + V_3$

$3V_1 - 6V_2 - 4V_3 = 0$

• Regla de Cramer

$N_1 = 5V_1 - 2V_2 - 3V_3 = 60$

$N_2 = 4V_1 + 5V_2 = 0$

$N_3 = 3V_1 - 6V_2 - 4V_3 = 0$

$$A = \begin{bmatrix} 5 & -2 & -3 \\ 4 & 5 & 0 \\ 3 & -6 & -4 \end{bmatrix} ; \quad X = \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} ; \quad B = \begin{bmatrix} 60 \\ 0 \\ 0 \end{bmatrix}$$

$$|A| \begin{bmatrix} 5 & -2 & -3 \\ 4 & 5 & 0 \\ 3 & -6 & -4 \\ 5 & -2 & -3 \\ 4 & 5 & 0 \end{bmatrix} = (-100 + 72 + 0) - (-45 + 0 + 32)$$

$$-28 + 13 = -15$$

$$|A_{V_1}| \begin{bmatrix} 60 & -2 & -3 \\ 0 & 5 & 0 \\ 0 & -6 & -4 \\ 60 & -2 & -3 \\ 0 & 5 & 0 \end{bmatrix} = (-1200) - 0$$

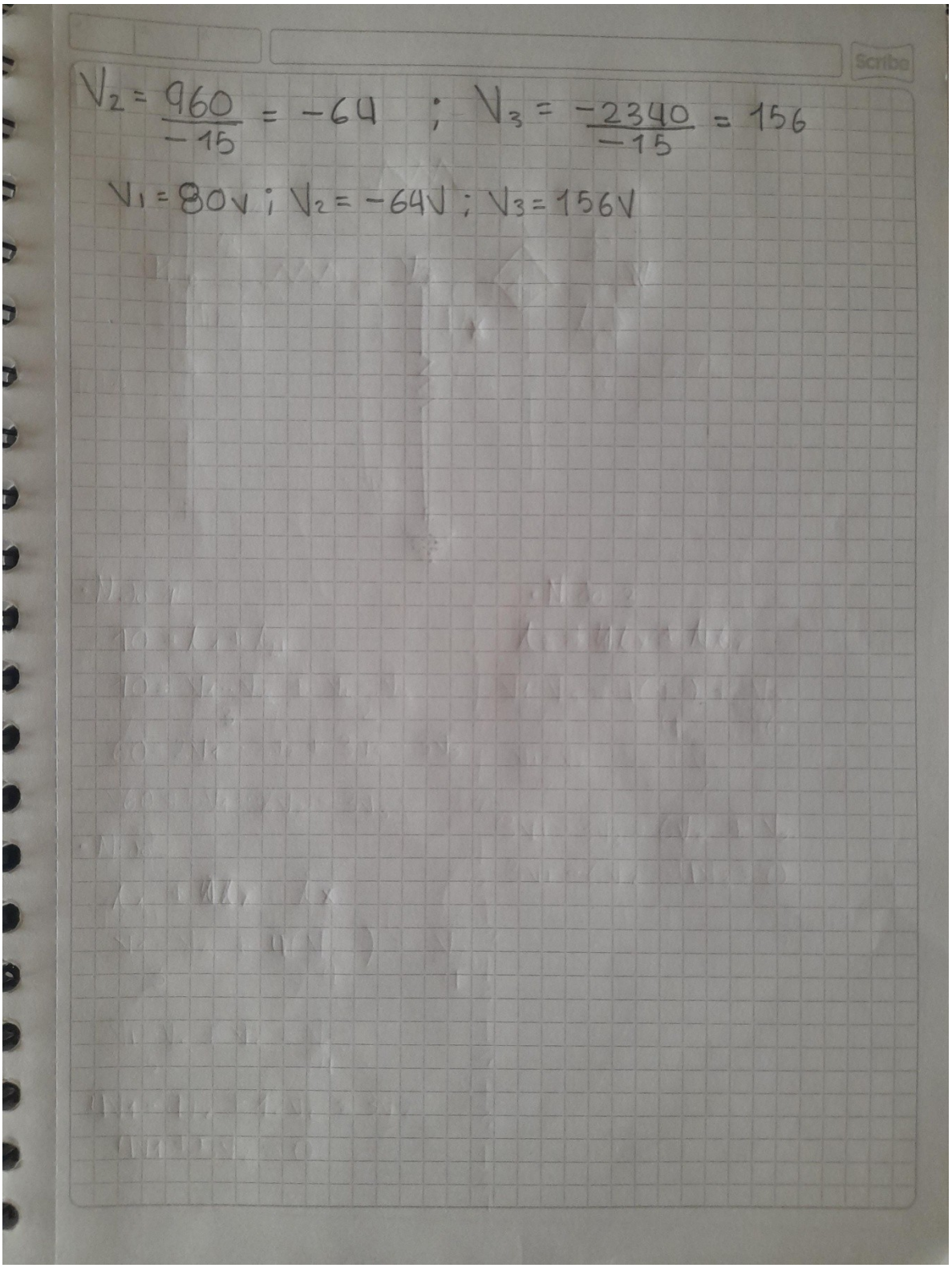
$$= -1200$$

$$|A_{V_2}| \begin{bmatrix} 5 & 60 & -3 \\ 4 & 0 & 0 \\ 3 & 0 & -4 \\ 5 & 60 & -3 \\ 4 & 0 & 0 \end{bmatrix} = 0 - (-960)$$

$$= 960$$

$$|A_{V_3}| \begin{bmatrix} 5 & -2 & 60 \\ 4 & 5 & 0 \\ 3 & -6 & 0 \\ 5 & -2 & 60 \\ 4 & 5 & 0 \end{bmatrix} = (-1440) - (900)$$

$$= -2340$$

$$X_K = \frac{|A_K|}{|A|} ; \quad V_1 = \frac{-1200}{-15} = 80 ;$$

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